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The MONTHLY REVIEW

Published Monthly by the

American Electro-Platers Society

A SOCIETY FOR THE ADVANCEMENT
OF THE
SCIENCE OF ELECTRO-PLATING

Newark Branch Number

JUNE, 1923

Entered as second-class matter, September 26, 1922, at the Post Office at Oneida, N. Y., under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage, provided for in section 1103, Act of October 3, 1917, authorized September 26, 1922.

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THE CURE-ALL

Breathes there a man with so much nerve,
Who says my dope will always serve,
No matter how your troubles curve,
Who says that when a solution's sick,
My bunkerite will turn the trick,
And always make the metal stick.

If for our bunkerite you pay
And make the solutions in our way,
They just get better day by day,
Your troubles vanish over night
And all your plating days are bright,
If you'll but use our bunkerite.

If there be such, go mark him well,
Though magic solid he may sell,
It isn't worth its room in the plating shop
And doubly dying, he'll be thrust,
Back to the place from whence be bust
Unswept, unhonored, but not uncust.

—Hedley J. Richards.

MONTHLY REVIEW

Published by the

American Electro-Platers' Society

ONEIDA, NEW YORK

Editor's Office, 166 Willow Place, Sherrill, New York

VOL. X JUNE, 1923 No. 6

EDITORIAL

1923 CONVENTION

The annual convention of the A. E. S. will be held in Providence, R. I., July 2-5.

It is hoped that every member of the A. E. S. who can possibly go will be in attendance.

Let us suggest that if your employer has not been in the habit of sending you to the annual convention that you talk it over with him, suggest that it would be to his advantage to have you there, and that he send you; tell him to try it as an investment and see if it don't pay good dividends.

The convention needs you, but you need the convention more than the convention needs you.

Your employer may not even know that there is going to be such a convention; tell him about it. Tell him that the foremost concerns where plating is done are sending their platers, because they want to keep up to date in electro-plating practice.

The 1923 convention gives promise of an exceptional fine program from the standpoint of both education and entertainment. So let's go for an all-around good and profitable time in Providence.

Special Notice to all who attend the convention: Certificate plan of reduced rates will prevail. Ask for a delegate's certificate to A. E. S. Convention when you purchase your railroad ticket. If enough of these certificates are secured it will mean reduced rates on the return trip.

MASTER ELECTRO-PLATERS

By Edward T. Faint, Newark Branch

In presenting remarks under such a topic, I realize that no matter how much one may say, the subject will still be inadequately covered.

It might be well to divide the masters into classes, namely, The Old Master Electro-Platers and the Modern Master Electro-Platers.

Due credit must be given to all those who, through patient searching, found out that electro-plating could be made possible. Little did they dream that the art would ever reach to such vast proportions as we find it today.

Yet, as we review the work of the old master, we are surprised to discover how wisely they laid the foundations. Have you ever taken the trouble to examine some antique that has come into your hands? Were you not astonished at the durability and stability of the deposit? The adhesion was so perfect that the plating seemed almost inseparable from the article.

In those days they had not the advantages that are at our hands today. If they wanted anodes they were obliged to get some metallurgist to especially make them; salts they in many cases made themselves, and yet notwithstanding they succeeded in getting durable, lasting results.

They must have been thinking men, sincere and untiring in their efforts, ever seeking after more knowledge and truth.

After practical tests they made record of that which they found that it might help the future generations. When I was about 18 years old, my own father told me of the methods used by Barnard & Sons, silversmiths, London, England, when he worked there some 60 years ago, and they compare very favorably with the modern methods of today, at least in the silver-plating department. This work was of fine quality and some of the products can be found in perfect condition even to this day.

Let us therefore honor the old masters and instead of speaking in a disparaging way about them, try to fellowship with them by going over our literature, seeking for the truth as they believed it and left it to us. If we do this, no doubt we will be proud of the heritage they left us and

praise them for their failthfulness and loyalty to the electro-plating industry.

Modern Masters—As we look back over what we might call the modern period we find that electro-plating has grown tremendously. No civilized country can be mentioned that does not have some sort of an electro-plating industry.

The growth of the industry has been in most cases due to large industrial interests. Again we find the old adage true, "Necessity is the mother of invention." When the manufacturer wants to make his wares attractive and more saleable he falls back to the electro-plater to help him out, but just as soon as you produce a fine-looking article, then he wants as good an article at a much cheaper price, and it becomes necessary to speed up operations, and this has been done to such an extent that it is truly overdone, for we find in almost every case speed beyond a certain limit becomes a detriment to quality.

Truly, many have been the achievements of the modern masters, since 1840. One of the greatest is the modern dynamo, instead of the batteries. Much of the credit for the pioneers in the perfecting of the same is due to a firm located in the city of Newark, N. J. Advancement has been made chemically. We no longer are obliged to prepare our own salts, but we can procure most anything we need of a good quality from the chemical jobbers.

Anodes—Marvelous improvements have been made by the metalurgists along this line, and they are still striving for more perfect products.

Cleaning compounds are sent to us in convenient forms, generally pulverized, instead of in one solid lump of 500 lbs. each, as we used to receive it.

Also mechanically much has been accomplished, and there seems to be no end to the devices that are called to our attention constantly in the trade journals, etc.—barrel platers, agitators, automatic cleansers, picklers and plating conveyors—in fact, in some instances, we find all these operations consistently and successfully combined in one unit.

What is true of automatic machinery in plating is also true in polishing and buffing, although we have not quite

reached the stage where we can announce that our products are never touched by human hands in their course of process of finishing. Some day we may reach that goal.

Have we built as well as the old masters, especially when we consider our increased advantages? If it were possible for the old masters to return and review our work, would they be proud of our progress? Well, we will leave that to the individual to answer.

One fact we must not lose sight of is that while in the days of the old masters electro-plating was a sort of a luxury, today the people everywhere demand it, and it is now a real necessity. The Government calls electro-plating a key industry, so we find progress has been made even in the eyes of the Governments of the world.

One might go on for hours in this strain, but what good would it do to our industry?—not much unless it made us all sit up and take notice, and I trust what has been said will make each one feel just a little more interested in the world's progress and encouraged to put a little more pep into their work.

The average electro-plater is like the grandson of a good old Presbyterian lady who warned him: "You must do this, and you musn't do that—you'll be doomed if you do, and you'll be doomed if you don't."

It sure does take a strong character to try all things, and to hold fast to that which is good.

Admitting some progress has been made, what part has the A. E. S. had in the march of progress since its organization in New York city, 1909?

Well, it has done much to bring into the light many mysterious theories, and through patient and studious labors of the members and chemists, and even by the aid of the Government, through the Bureau of Standards, we have been able to reasonably solve some of the problems.

We have had the benefit of a monthly publication, where we can see in print our views and ask questions and expect answers. This work alone is indeed worth while, but that is not all. I believe the greatest factor of the A. E. S. is the spirit of genuine fellowship exhibited among its craftsmen.

Is it not a fine piece of work for 1,000 men to be working together, without bickerings or jealousies, not trying to seek undue advantage of one another, but rather endeavoring to help each other?

It is true we are quite conscious of our human weaknesses, but with it all we are still friends. You will all recall that definition of a "Friend": "A Friend is one who knows all about you and still trusts you."

Have you not found this to be true, at least in spirit, by the members of our branch? We have found it so in the Newark Branch.

There is much work yet to be done. I will not try your patience by enumerating them all. Here are a few:

A perfect cure for all spotting out, in all deposits, more noticeably in brass and copper deposits. There are many remedies, but is there a cure? Have we not all done our best, and at night, looking upon our work, felt a just pride at its beauty, but alas, the next morning as we looked on the same work we have used the exclamation of Lady Mac beth, "Out Damned Spot?"

"A perfect cleaner," one that will give a chemically clean surface, leaving no stains on the surface of the metal; one that can be easily controlled and constantly reliable. "It is yet to be produced."

"More perfect adhesion of all electro deposits." Examine, if you please, the wares on the market today and see how many present imperfect plating—not like some of the work produced by the old masters. Why, you could not start some of them peeling by hitting them with a hammer.

There is a great need for a more perfect copper plating solution—if possible, one without the use of sodium or potassium cyanides. Such a solution would be very much more healthful to the operators. Can we produce it?

"Brass solution." There is a very urgent demand for brass deposits from 1-16″ to 1-8″ in thickness. Can we supply it?

How about the nickel solutions?

Have we a perfect solution that will keep constant without frequent additions?

Can we deposit faster from a very dense solution or

from a weak solution? Has this subject been satisfactorily settled? If so, how?

Should a nickel solution be kept acid or slightly alkaline? No two authorities agree thoroughly. Yet it seems that the fact remains that one way must be the best way.

What is the best way to test the hydrogen ion content in a nickel solution? Several methods are now being used.

Should nickel solutions be agitated? If agitated, by which method?—air, mechanical, or gravity. Can best results be obtained by constant filtration or shall we allow from 6″ to 12″ of mud to accumulate at the bottom of our tanks?

At what current density can we obtain the closest grain deposits?

Does it pay to use rapid plating solutions? What advantage is there in a continuous automatic device for nickel-plating?

What thickness of nickel-plating on iron and steel should be standard?

I have not forgotten that ever-present malady, "pitted nickel deposits."

Do I hear someone say we have a cure! If you have the cure, do not rest day or night until you make it known at least to the A. E. S. at large.

We need a better way to protect our finishes than the present lacquer method (although that is very good), so that a thing of beauty may indeed be a joy forever.

How shall we answer these and many other important matters?

Permit me to call your attention to an editorial in the July, 1922, REVIEW, "Essentials to Progress," and again in the September, 1922, "Little Things." Above all, observe and patiently try to improve your individual difficulties; master all obstacles.

It will help you very much if you are faithful in your attendance at the branch meetings; use it as a medium of approach and use the REVIEW, it is your organ for publicity to disseminate knowledge.

We have a firm foundation upon which to build, and as master electro-platers, let us see to it that we build upon it and that we build well.

THE PRODUCTION OF BRIGHT NICKEL DEPOSITS

By the Aid of Cadimum as the Colloidal Factor

By Charles H. Proctor

It is the aim of the electro plater who must produce large quantities of a nickel plated product upon a commercial scale to produce a dense adherent and bright nickel deposit especially so in mechanical barrel plating. When such results are gained during the plating operation followed only by regular washing in cold and boiling waters and drying out in maple wood sawdust or by the aid of the centrifugal hot air dryer direct from the cold water washing, it means a great saving in a year's time, when the cost of labor and material is considered, which must be used when nickel deposits come from the solutions with a dull or only a semi-bright surface, necessitating the additional labor and material to produce the bright nickel surface so much desired from a commercial standpoint. Even when still nickel solutions are used for plating articles that cannot be plated in a mechanical barrel, the resulting bright nickel plated surface that can be obtained saves considerable money in a year's time in buffs and polishing materials as well as a lower cost for labor to obtain the final bright nickel finish of commerce. The use of colloids in electro plating solutions and in the electrolytic refining of metals has been practiced for years. Possibly the first use made of a colloid or what has often been termed by many experimenters an additional agent for the production of dense bright non-crystalline deposits was first used by Milward in 1847 when he discovered that the addition of small amounts of bisulphide of carbon to cyanide of silver plating solutions caused the deposit to show greater lustre and brilliancy instead of the dead appearance when no additional substance was used.

The names of Betts, Mathers, Watts, Overman and Cockrum are well known in connection with the use of colloids in the deposition of lead, tin, antimony and other metals of a commercial nature.

In 1911, considerable work was done in connection with electro deposits of copper from copper sulphate solutions by Ching Yu Wen and Edward Kern in the metallurgical laboratory of the School of Mines, Columbia University, N. Y., to determine the effects of organic and inorganic addi-

tion agents in the electrolytic deposition of copper from electrolytes containing arsenic. The use of arsenic in brass solutions and sodium hyposulphite and lead salts in copper solutions as brightening agents are well known to all platers. Various substances used in connection with acid zinc sulphate solutions, both organic and inorganic is a part of every-day commercial practice. In further continuation of the use of metal colloids the writer has recently patented a method in connection with a co-patentee for the use of mercury in the anode, as well as the solution, for all types of alkaline zinc solutions which are commonly termed cyanide zinc solutions.

Gum arabic and gum tragacanth have been used for several years as brightening agents in nickel solutions. The latter substance was the basis of a patent as the brightening nickel factor a few years ago. There are four types of colloids or additional agents used in electrolytes—organic, metallic and alkaline colloids. The latter was exploited a few years ago by Mason, an Englishman, who made an effort to startle the world by his so termed alkaline colloids additions to silver plating solutions in the form of potassium carbonate in amounts up to 24 ounces per gallon of solution. He claimed unusual rapidity of deposits of silver, the addition of the potassium carbonte enabling such tremendous currents to be employed upon a cathode surface as equal to five amperes per square foot of surface. At the same time that Mason was exploiting his wonderful discovery twice the amperage he claimed was being used in the United States by efficient silver platers upon an equal cathode surface. The several authorities who have advocated the use of organic and inorganic colloids have never been able to thoroughly determine the true action of the colloidal substance upon the deposit.

(The late Dr. Joseph Richards in discussing the use of colloids following a paper read at the ninth general meeting of the American Electro Chemical Society at Ithaca, N. Y., May 2, 1906, by Ralph C. Snowdon on the "Electrolytic Precipitation of Lead From Acetate Solutions," said: "I wish I could—I have wished many times that I could say in some definite words to my students what the effect of adding these colloids to the solution was; that is the rationale

of this effect; but it certainly is not due to the reducing action. It appears to me that it is the effect of the added substance upon the crystallization of the deposit; that is upon the adhesion of one crystal to another and by the growing out of the crystals in one direction. It apparently breaks up the tendency to the crystals attaching themselves to one another as they do ordinarily from a lead nitrate solution.") In metallurgy, we know that small percentages of nickel, manganese, chromium and vanadium give added strength and improve the texture of steel. Such additions may be considered in a sense as colloidal and the inference drawn by Dr. Richards would have an important bearing upon the conclusive evidence of the action of the metals mentioned upon the crystalline structure of alloyed steels. In the nonferrous alloys, the additions of phosphorous in the form of phosphor copper and tin and other metals have an important bearing upon the strength and toughness of such alloys. Recently I have experimented to some extent with additions of cadmium to nickel solutions as the metal colloidal factor in the production of bright nickel deposits. Cadmium is not mined as an ore; it results from the reduction of zinc by the smelting operation, the cadmium being more volatile is obtained as a brownish powder and is refined by distillation at low red heat with reducing materials. The electro-plater uses the metal for the purpose outlined in the form of anode sticks attached to the anode pole. He finds that by using the cadmium as anodes he can obtain better control over the brightness of the nickel deposit by this method . When the nickel solution has become accustomed to the addition of cadmium, very little trouble is experienced by its use if care is used. It is, however, in the preparation of an entirely new nickel solution when cadmium is used as anodes that the trouble commences. Many times I have answered questions to the effect that "I have recently prepared a new nickel solution for bright nickel. Am using cadmium in the form of anodes about the size of a wet electric bell battery znic, 6 inches long. My nickel deposit is dull and streaked with gray black marks. What can I do to remedy the trouble?"

Such results are generally the case when the cadmium anodes are first used in the nickel solution instead of using

a salt of cadmium, such as the sulphate or chloride water soluble that can be thoroughly and intimately mixed with the nickel solution before the plating operations actually commence. When cadmium anodes are used in a new solution an excess of cadmium may be drawn into the solution in the vicinity of the articles to be plated because cadmium anodes in nickel solutions prepared with chlorides of sodium or ammonium apparently reduce the cadmium more rapidly than the nickel, resulting in an unequal deposit, which is the cause of dull deposits and grayish streaks so frequently complained of. The preparation of the solution for bright nickel deposits by the aid of cadmium is also important as results have shown with the correct type of nickel solution was surprising how much cadmium sulphate could be used without detrimental results to the deposit. The following formula for nickel solution was advocated for bright nickel plating, with addition of cadmium sulphate:

Water	1 gallon
Single nickel salts	12 ozs.
Nickel chloride	1 oz.
Boracic acid	2 ozs.
Cadmium sulphate	½ grain to 1 grain

The results obtained from this solution, after many trials, were unsatisfactory, as samples will show.

No. 1. Sample is a piece of hot rolled steel cleansed from scale, etc., and scratch brushed wet.

No. 2. Is a similar piece of steel plated in the above solution with several repetitions for 20 to 30 minutes' deposit. The dull deposit and characteristic gray black streaks infer that the solution would not give a bright nickel deposit, It was decided that the solution was deficient in a reducing and conducting factor, so it was decided to add ammonium chloride to accomplish the double purpose. A solution was now prepared as follows:

Water	1 gallon
Single nickel salts	12 ozs.
Nickel chloride	1 oz.
Boracic acid	2 ozs.
Amonium chloride	2 ozs.
Cadmium sulphate	½ grain to 1 grain

Temp. of solution, 75° Fah.; voltage, 3 to 4; amperage, ap-

proximating 35 amperes per square foot of surface.

No. 3 sample shows that the addition of ammonium chloride to the solution results in a normal deposit, the edges showing a slight burning, but brither than the steel itself.

No. 4 sample shows the results of the addition of 2 grains of cadmium sulphate to the solution.

No. 5 sample shows results when cadmium sulphate was added to the solution up to 7-10 of a grain per gallon, equal to about 11 grains per gallon.

No. 6 sample shows a piece of ordinary steel chain plated with amount of cadmium given above. The experiments, although not very extensive, prove that it is advisable to add the cadmium in the form of a salt to the nickel solution first to obtain uniform distribution, which does not result when cadmium anodes are first used. When the nickel solution has been operated for some time, or when the nickel deposit shows an indication of becoming dull, then a minute amount of cadmium sulphate may be added, followed by the use of cadmium anodes which, however, must not remain constantly in the nickel solutions, or an excess of cadmium may result. An excess of cadmium in the nickel deposit produces a brittle deposit; furthermore, a slight yellowish stain will frequently result in drying out of nickel deposit when an excess is used.

From two to three grains of cadmium sulphate per gallon of nickel solution will prove ample. The addition of minute amounts of pure hydrochloric acid to the solution is advisable at an interval of two days. When the solution is constantly operated 1-16 to 1-8 oz. per gallon of solution will be ample. Under such conditions as outlined, cadmium will be found a very beneficial material for bright nickel deposits.

CORRECTION

In the April number of the MONTHLY REVIEW the name of Thos. Murray, 8 Pleasant street, East Longmeadow, Mass., was listed as having been suspended from Connecticut Valley Branch.

Mr. Murray applied for admittance as an active member on April 17, and his name was sent in as an applicant for membership.

Will you kindly correct this error in the next number of the REVIEW?

Sincerely yours, TENNANT ELWIN, Secretary.

NICKEL PLATING ON ALUMINUM

By DeWitt Moore, Newark Branch

Fifteen years ago I was required to nickel plate aluminum and I found it to be a very difficult problem; it would either peel or blister.

The reason is that aluminum is of a greasy nature, very readily attacked by all alkaline solutions. If cleaned in any of our ordinary cleaners there is an oxide formed upon the surface of the metal, and this oxide must be removed before nickel will adhere permanently.

After much experience, covering a number of years; also as late as 1922, during which time I have successfully plated large quantities of aluminum daily, and very seldom found a blistered or peeled piece of work, when I followed the method about to be given:

First—The polished aluminum parts should be washed in benzine and dried in sawdust. This operation removes all excessive grease.

Second—Parts are wired on copper or iron wire.

Third—Work is placed in a Kalye electric cleaner as cathode for from 6 to 8 seconds, washed in cold water, dipped in a nitric acid dip (water 3 quarts, nitric acid 1 quart) to remove the oxide formed in the electric cleaner, then rinsed in cold water, a momentary dip in a cyanide solution; final rinse in clear, cold water and placed in nickel strike as quickly as possible.

Nickel strike solution made as follows:

Double nickel salts	12 ozs.
Single nickel salts	2 "
Boracic acid	3 "
Magnesium sulphate	3 "
Water	1 gallon

Use 4½ volts.

Time in strike, 2½ to 3 minutes.

The work is now removed from strike solution and plated in the regular nickel solution for ½ hour to ¾ hour or longer time if desired. The voltage used in the regular nickel bath is from 1½ to 2 volts.

Although I have discovered other methods for nickel plating aluminum, this method I consider the most practical and has given success.

"RAPID NICKEL PLATING"

By Royal F. Clark

To nickel plate rapidly a hot electrolyte must be used and success depends upon several factors, viz.: temperature, the nickel, acid and chlorine content. Most any nickel solution will deposit at a higher rate if heated. Therefore, it matters not as to what the composition of the bath is, but if a nickel solution contains considerable metal and is operated at a high temperature, much more work can be turned out in a given time.

On certain classes of articles the bright nickel solution can be used, which will eliminate subsequent buffing or coloring. This paper is based upon the experience of the writer in operating 38 nickel tanks of 150-gal. capacity each, 10 of which were run hot, on cast iron shears for a period of three years; also one tank of 75-gal. capacity for two years on brass, nickel silver and steel bag frames. Both classes of work would not permit the use of a very high current density with the hot solution because of the subsequent operations to which they were subjected, but on other classes of work there may be possibilities of considerable value.

Certain classes of work done in bulk and to be gold plated either in 14 kt.-22 kt. or 18 kt. green gold, can be flashed in a hot nickel solution for a few seconds, rinsed in water and then gold plated. This method is excellent in cases where small receptacles, small anode surfaces, low gold content in solution are used; also when the maximum amount of work that can be held in the hand or put into the gold tank when jars of 12 inches in diameter are used, for instance.

This nickel deposit prevents the hot cyanide in the gold solution attacking the base metal. To give you an idea of the high temperatures at which a nickel solution can be operated, the following will be of interest: On April 18, 1922, electrolyte was used at a temperature of 140 Fahr.—60° cent. analyzing as follows: 5.04 oz. Ni. per gal. 4.5 CC NH. OH, 4.26 NH C1, slightly acid to litimes and 19° BE. At another date, 22° BE-123 F-50° cent., 24° BE 113° F.-45° BE-135° F-57° centrigrade. Any temperature from

100° Fah. to 140° F. or higher can be used. Yesterday a solution at 12° BE at 115° Fah. 1090 spe. grav. was operated with excellent results at room; temperature this morning, it was 15° BE-1110 spec. grav. I observe that a higher amperage passes at a lower voltage in a hot solution when operated alongside of a tank of cold electrolyte.

BLACK NICKEL FINISH

By J. De Mars, Newark Branch

Have your tank set up in the proper place, fill it within 4 inches of the top with clean, cold water. Now take 40 lbs. double nickel salts and place them into the water in tank. Allow the salts to dissolve in the cold water. Keep the salts always near the top, as in this way it dissolves more thoroughly and faster. When the nickel salt is all dissolved, take 6 lbs. sulpho-cyanide of potassium and dissolve same in some of the solution. When it is thoroughly dissolved add it to the solution and stir well. Next take 1 lb. sulphate of zinc and dissolve thoroughly in cold water and add to the solution. Stir well. This completes the bath. The formula, of which is 1 gal. water, 10 ozs. double nickel salts, 1½ oz. sulpho-cyanide of potassium, ¼ oz. sulphate of zinc.

Now put in nickel anodes. It is better to use anodes which have been in use and have the scale worked off. Clean them before putting in. There should be enough anodes to just about fill both sides, or in other words, just the same as in doing white nickeling.

Have tank fitted with volt meter and with a rheostat of sufficient resistance to allow of getting the voltage down to ½ volt with work in tank.

Prepare your work in the usual manner and run for 15 or 20 minutes in the white nickel, then transfer to the black nickel and run at ½ volt for 1 hour. Then increase the voltage to about ¾ or 4-5 volts and run at this voltage for ½ hour. The work should then be ready to take out.

Take work out, rinse in clean, cold water and plunge quickly into clear, cold muriatic acid. If the acid is too strong and produces irridescent colors upon the work, add a small quantity of water. Rinse the work in cold water and then into warm water and dry in clean sawdust, or it is

sometimes better to swing the work dry, as in this way it is not so liable to become scratched. This work should be lacquered, as the lacquer improves the appearance and lasting qualities of the finish.

In maintaining the bath, if it becomes weak in metal, nickel may be added in the same manner as originally, and if the color is not deep enough a small quantity of the sulpho-cyanide and zinc may be added as before. In replenishing the bath, never use more than ¼ oz. to the gallon of either the sulpho-cyanide or sulphate of zinc.

FINENESS OF GOLD KARATS

KARAT	
1	.0417
2	.0833
3	.1250
4	.1667
5	.2083
6	.2500
7	.2917
8	.3333
9	.3750
10	.4167
11	.4583
12	.5000
13.	.5417
14	.5833
15	.6250
16	.6667
17	.7083
18	.7500
19	.7917
20	.8333
21	.8750
22	.9167
23	.9503
24	1.0000

18Kt. Green Au.
Specific gravity 15.88

Gold	750 parts
Silver	219 "
Copper	31 "

18Kt. Yellow Gold
Specific gravity 15.18

Au.	750 parts
Ag.	62.5 "
Cu.	187.5 "

18Kt. Red Au.
Specific gravity 14.91

Au.	750 parts
Cu.	250 "

14Kt. Green Au.
Specific gravity 14.17

Au.	583 parts
Ag.	365 "
Cu.	52 "

14Kt. Red Gold
Specific gravity **12.93**

Au.	583 parts
Cu.	417 "

10Kt. Yellow Gold
Specific gravity **11.78**

Au.	417 parts
Ag.	146 "
Cu.	437 "

10Kt. Red Au.
Specific gravity **11.42**

Au.	417 parts
Cu.	583 "

14Kt. Yellow Gold
Specific gravity **13.26**

Au.	583 parts
Ag.	104 "
Cu.	314 "

Specific Gravities.

18Kt.	green Au.	15.88
"	yellow "	15.18
"	red "	14.91
14Kt.	green "	14.17
"	yellow "	13.26
"	red "	12.93
10Kt.	yellow "	11.78
"	red "	11.42
Sterling	Ag.	10.41
Brass (wrought)		8.40

THE THEORY OF CLEANERS

By G. S. Robins, St. Louis, Mo.

I shall confine my paper tonight only to the theories explaining the workings of the various classes of cleaners.

Cleaners may be divided into three general classes: No. 1, Saponifiers; No. 2, Scrubbers; No. 3, Solvents.

Under No. 1 we have alkalies principally Caustic Soda, Soda Ash, Caustic Potash, Salsoda (which is simply a modified Soda Ash). All of these work on the fatty grease only —that is, the saponifiable grease. Caustic Soda is NaOH (Na_2OH plus H_2O); Soda Ash is Na_2CO_3 (Na_2O plus CO); Caustic Potash is KOH (K_2O plus H_2O). In each instance you note there is the same combination present that is Na_2O (in the case of Caustic Potash it is K_2O). This is the active part—the part that grabs the fat to form a soap of it and the soap is easily removed by water. Caustic Potash (now still expensive to use) works a little faster because it forms soft soaps which wash off more readily than hard soaps. Caustic Soda and Soda Ash form hard soaps. However,the difference is not commensurate with the difference in cost.

If your work was greasy only from animal or vegetable grease, all you would have to do would be to hang it in Caustic or Soda Ash solution for a few minutes and all would be cleaned quickly. But Mineral Oil and Grease, which is the principal scum on the work, is not saponifiable and hence the necessity for the second class of cleaners, i. e., the scrubbers, so called because their action is mechanical and not chemical.

First and foremost and most effective of the scrubbers is the man with scrubbing brush and strength of arm. He can mechanically brush off the oily grease.

Second is the chemical method. To remove a scum of mineral oil is a real job. It can't be saponified and it can't be washed with water. You must form an elastic film around the particles of oil which will spread them apart from each other and separate them from the metal surface. Colloids will form such films desired. Then we must introduce Colloids.

The most common Colloidal substance is soap. When soap, which is principally Sodium Stearate, is acted on by water it splits up or hydrolizes into Caustic Soda and

Sodium Acid Stearate. Sodium Acid Stearate is what you see as lather. The lather forms the necessary film around the oil and the oil can thus be removed. The Caustic Soda will help saponify any animal or vegetable grease present.

More efficient Colloids, however, are obtained from Tri-Sodium Phosphate and Sodium Aluminate. Tri-Sodium Phosphate (Na_3PO_4) splits in water to form NaOH and H_3PO_4 (P_2O_5 plus H_2O). Sodium Aluminate (Na_3ALO_3) forms NaOH plus H_3ALO_3 (Al_2O_3 plus H_2O). In each case the Colloid formed by either the phosphate or aluminate group produces the elastic film around the particles of oil.

Because of the fact that animal and vegetable greases are used as binders in nearly all abrasives and drawing compounds, there is nearly always some saponifiable grease along with the mineral on the work. Hence any one of the colloidal substances should be accompanied by an alkali so as to quickly remove both forms of grease. And this is the essential feature of the so-called patent cleaners—the proper balancing of colloid and alkali to remove both kinds of grease with the least injury to the metal and the hands of the workmen.

The third method of scrubbing is by means of gas produced on the work by the electric current running through a solution of Caustic Soda. No matter what cleaner you use in your "electric clean" your gas is produced by the decomposition of Caustic Soda—NaOH. The Sodium being positive goes to the cathode (the work). Here it unites almost explosively with the water, thusly Na plus H_2O—NaOH plus H and the H or Hydrogen being a gas, goes bubbling up through the solution, right along the side of the work and brushes off all the grease that can be brushed. If there is any grease of a saponifiable nature present, the Caustic Soda which is formed again, will make a soap of it right then and there.

Put a collodial substance such as mentioned before in your "electric clean" and you thus make it that much easier for the Hydrogen bubbles to scrub the work because the colloid will form a film around the oil and render it much more easily removable.

Before going on to the third class I want to draw my general deduction at this point because it logically follows

here. My conclusion is that there are very few shops which have exactly the same cleaning problem. There is not a cleaner on the market which will clean efficiently—that is thoroughly clean in the quickest time and at the lowest cost—for everyone because the amount to be cleaned in nearly every shop is different. Consequently, it requires more study for each plating foreman to determine the amount of alkali and the amount of colloid which gives him the best results. He should also determine whether or not he can more economically use the electric clean and if so, whether or not he should introduce colloids into the bath. To get a line on the proper formula it is not necessary to make up several tanks of solution. First determine what kind of grease you are dealing with and then experiment along the lines outlined to deal with that grease. These experiments can easily be worked in one gallon or five gallon jars.

The third and last class of cleaners are the solvents.. In these the grease dissolves just as sugar dissolves in water. Both the animal and mineral greases are soluble in such solvents as gasoline, benzol, naptha, carbon, tetrachloride, chloroform and acetone. These solvents are for the most part non-injurious to metals (carbon tetrachloride and chloroform will attach iron to some extent) and consequently are used only when you cannot use a strong alkali cleaner such as on lead, zinc, antimony and tin, all of which are soluble to a greater or less degree in alkalies. The solvents, however, are either too inflammable or too expensive for extensive commercial use. For the most part they are good cleaners and I would suggest that some one of our members invent an apparatus in which the work could be tumbled through a bath of gasoline or benzol, properly protected so that the solvent did not have a chance to evaporate into the room and thus clean quickly and thoroughly. The solvent could be recovered by distillation when the solution became saturated with grease.

Until such an invention is brought forth, however, please make a study of the cleaning problems in your own shop. Perhaps you will have to use two or three different cleaners for different classes of work, but the results will be well worth the study.

BRANCH NEWS

Toronto Branch

Toronto Branch held their regular meeting on May 28, President E. Coles presiding. After the routine business was disposed of, the elections came next: W. S. Barrows, elected president; J. S. Cairns, vice-president; E. Coles, 66August Ave., secretary; Thos. O'Keefe, librarian; Alex Armstrong, sergeant-at-arms; J. Acheson, W. Cox, J. Young, trustees.

Mr. Rhulman also gave us a very interesting talk on lacquers, polychrome and pigment finishes. The boys were asked to bring their problems, and it sure made things lively for the speaker. A general discussion on brass plating took up the remainder of the evening.

Connecticut Valley Branch

Connecticut Valley Branch met on May 28, with Vice-President Vibberts in the chair and eleven members present. Four applicants were elected to active membership and one member was received by transfer from Bridgeport, which brings the total membership of this branch to thirty, an increase of eleven members during the past year.

The annual election of officers then took place and the following were elected: President, George E. Vibberts; vice-president, Wm. J. R. Kennedy; secretary-treasurer, Robert Mandeville; librarian, Tennant Elwin; board of managers, Chas. E. Dunn, H. M. Roberts, E. N. Miller.

The retiring officers were given a rising vote of thanks for their work during the past year.

President Vibberts presented the branch a question box and announced that he would be the first to use it. It is hoped that the rest of the branch will follow his example and give the other members something to talk about.

A number of open meetings will be held during the coming year in Hartford, New Britain and Springfield. Speakers of prominence will be featured and it is expected that these meetings will create an interest in the work of the society and bring in some new members.

One of our newly elected members, Mr. Roberts, gave a brief talk on his method of nickel plating and burnishing brass shells.

Bridgeport Branch

Report of Bridgeport Branch June 1: Meeting called to order at 8 P. M., with President J. W. Slattery presiding. Two applications read and approved of to become active members. Mr. Oberender of the convention committee read a report on the coming convention, with mention made of the daily program, and from all indications will be some conven tion.

Questions upon throwing power of acid copper were discussed and many opinions given. Owing to the lateness of the hour it was decided to again have this topic at our next meeting.

Meeting adjourned at 11 P. M., to again meet on June 29, with a spe cial meeting called.

Philadelphia Branch

June meeting of Philadelphia Branch was held June 1, with a good attendance, and Geo. Gehling presiding.

One application was received and then other routine business was transacted.

Secretary Uhl gave a good boost for the convention and from all accounts Philadelphia will be well represented.

No meeting of the branch will be held in July.

Montreal Branch

At our last meeting, May 25, Mr. J. T. Madden was elected president; Mr. Frank Green, vice-president; Mr. John C. Feelay, secretary-treasurer; Messrs. R. Chalut, Jack Shaw, J. A. Blaxoll, board of managers for the new term. Under the order of new business a discussion came, whether Montreal branch was in favor of holding 1924 convention in the City of Montreal if it was possible to be gotten. The president left the chair, then vice-president presided. After explanation by the president it was moved by Mr. E. B. Davidson, seconded by R. Chalmh that the delegates be instructed to bring the matter before the council and do all in their power that this honor be granted to them.

Detroit Branch

Meeting of Detroit Branch, A. E. S., held Friday, June 1, Vice-President T. C. Eichstaedt presiding, as President B. F. Miller was unavoidably detained until late.

Mr. Hart of the Devine Company was a visitor, but with his usual modesty, retired before we called upon him for remarks. Minutes were read and approved.

Smoker question laid over until fall.

Good of order—Question by Lovering, "What is benedictine nickel?" It is said to be nickel, 20 per cent.; zinc, 15 per cent.; balance copper; full analysis will be given by R. L. Shepard at next meeting, who will also have Bernard F. Lewis, electro-chemical expert of Shepard Art Metal Company, demonstrate Dr. Blum's method of acidity content of nickel solutions some evening. Detroit is certainly fortunate in having such men in its branch of the society.

Discussio on advisability in securing reasonable engineering specifications from various plant engineers.

Question, "What causes nickel to burn at times at 3 volts, while at others 5 could be used?" brought forth the information that no amperes were specified in either case, therefore no solution could be given.

Spirited discussion on J. A. Murphy's formula for brightener for nickel solutions was freely indulged in, and Mr. P. L. Shepard also told his method of determining additions of lead acetate and glycerine to same.

Prof. Baker of Ann Arbor will also be requested to demonstrate Dr. Blum's method for acidity later.

St. Louis Branch

At our June meeting letters were read from members of our branch located at Atlanta, Ga.; Los Angeles, Cal.; Grand Haven, Mich., and Wichita, Kan. Glad to hear from them.

After transaction of routine business the new officers were installed by H. J. Richards in an original manner, with words appropriate to each officer, rather than the office. It was a delight to Mr. Richards to install as president F. Menniges, who for several years was assistant to him, when he had to work for a living. Mr. Menniges is the second former asistant foreman plater to become our president.

It was rather embarrassing for the secretary when Mr. Richards informed him that he was the Goat. This he proved to his own satisfaction when he mentioned the work done and the little credit sometimes given that office.

'Hedley" was given a rousing vote of thanks as a compliment for his service as installing officer.

Under educational features the subject of "Cleaning" was gone over in a general way.

The Board of Managers were instructed to arrange our annual outing in August.

Waterbury Branch

At our meeting last night the following were elected officers of Waterbury Branch for the year 1923-1924: President, Mr. Wm. Gray, 10 Calumet street, Waterbury, Conn.; vice-president, B. W. Snogg, 42 Prospect street, Ansonia, Conn.; secretary, Wm. Guilfoile, 230 Cooke street. Waterbury, Conn.; treasurer, Wm. Delage, Box 463, Waterbury, Conn.; librarian, John Messick, 185 Woodlawn Terrace, Waterbury, Conn.; board of managers, Messrs. Norman Tice, Harry Johnquest, Hugh Byrnes.

We expect to have a good representation at the convention.

Newark Branch

The regular meeting of the Newark Branch, A. E. S., was held on June 1, at 17 Central avenue, Newark, N. J., there being 18 members and visitors present.

President Clark sounded the gavel calling the meeting to order at 8:30 P. M.

Roll of officers was called and all found to be present.

Minutes of the last meeting were approved as read.

Meeting was then turned over to our librarian, Mr. Faint.

Mr. De Vote read a very interesting paper on the blueing and browning of steel novelties by the nitrate method. This paper was well read and very well received, and by the discussion which followed showed Mr. De Vote at his best. Samples were shown of work done at different degrees of heat.

Mr. Faint then read an article, the subject of which was, "Metals Have Diseases Like Men." Such metals as tin, zinc and soft metal deterriorate when exposed to the atmosphere and in the course of time acquire a disease.

ELECTED TO MEMBERSHIP

Hartford Branch

Thos. J. Murray, Active .....8 Pleasant St., East Longmeadow, Mass.
Chas. J. Griswold, Active .....P. O. Box 525, Westfield, Mass.
Geo. A. Dix, Active .....393 Park Ave., Hartford, Conn.
Harry M. Roberts, Active.....C|o Blake Mfg. Co., Springfield, Mass.

Detroit Branch

Benjamin Summerfield, Active .....5656 Rogers Ave., Detroit, Mich.

Providence Branch

John V. Mederia, Active.....55 East Transit St., Providence, R. I.
Frederick C. B. Strong, Active, c|o Beverly Plating Co., 74 Clicord St., Providence, R. I.

APPLICATIONS FOR MEMBERSHIP

Hartford Branch

M. A. McCarthy, Active.....84 Palmer Ave., Springfield, Mass.
Thomas Murray, Active .....8 Pleasant Ave., Longmeadow, Mass.

Bridgeport Branch

John F. Courtney, Active.....Basset Metal Goods Co., Shelton, Conn.
Fred R. Griffith, Active .....Columbia Graphone Co., Bridgeport, Conn.

Milwaukee Branch

J. Hock, Active .....310 Galena St., Milwaukee, Wis.

Detroit Branch

Harry E. Carr .....6562 Beechwood Ave., Detroit, Mich.

Newark Branch

Horace G. Gravell .....105 Kingsiands Road, Nutley, N. J.
Max Metch .....3804 Hudson Bvld., West Hoboken, N. J.

Philadelphia Branch

Donald F. Cranor .....Conshohocken, Pa.

TRANSFERS

Chas. E. Dun, 266 Preston St., Hartford, Conn., from Bridgeport Branch to Hartford Branch.
N. Zadowski, from Pittsburgh Branch to Cleveland Branch
John J. B. Drane.....From Boston to Providence, R. I.

RESIGNATIONS

Wenzel Schoennecher, in good standing, from Milwaukee Branch

SUSPENSIONS

Boston Branch—W. E. Clohessy, 32 Union St., Charlestown, Mass.

REINSTATEMENTS

New York Branch—John A. Cascella, 116 North Ave., Crawford, N. J.